

Testimony before the House Committee on Homeland Security, Subcommittee on Economic Security, Infrastructure Protection, and Cybersecurity

Title of the Hearing: **Leveraging Technology to Improve Aviation Security**

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... It is a privilege and an honor to be with you this afternoon to discuss a subject where I believe my company, Analogic Corporation, can make a real contribution in leveraging our technology to improve not only aviation security, but other modes of transportation security as well.

Analogic is an innovative, developmental engineering and manufacturing company based in Peabody, Massachusetts. Our revenue for the year 2004 was \$355 million. We conceive, design and manufacture high-performance, proprietary medical and security imaging systems, principally for leading international Original Equipment Manufacturers (OEM's).

Members of the Committee most likely know Analogic through our relationship with L-3 Communications. Following 9/11 we supplied L-3 with our Explosive Assessment Computed Tomography (EXACT™) system, which was the second certified Explosive Detection System (EDS) to screen checked baggage. Our EXACT systems are the heart of the L-3 Communications' eXaminer 3DX6000 EDS that is installed at airports across the country to comply with the Aviation and Transportation Security Act of 2001.

In 2003 we responded to requests from TSA to enhance those EDS units already in the field. We, along with Lockheed Martin, were awarded \$3.85 million under the Phoenix Category 1 Program to design and develop a system upgrade that would increase throughput, reduce false positive alarms and reduce EDS operating costs. Our field-installable EDS upgrade kit was certified this spring and we will start upgrading EDS units in the near future.

In addition to the important upgrade work, Analogic was awarded \$1.15 million for the first phase of a multi-million dollar grant under TSA's Phoenix Category 3 Program to design a new generation of advanced, networkable EDSs with significantly higher throughput and detection capabilities, targeted for delivery in 2007. These new units will further reduce EDS operating costs while providing improved security.

TSA also awarded us a cooperative agreement as part of its new Manhattan II Program to identify and develop revolutionary technologies into deployable systems that will significantly enhance automatic threat detection and discrimination capabilities for checked luggage for aircraft and other applications.

I trust this background on our intensive work in finding explosives in checked luggage was helpful in understanding our success to date, and to describe the close working relationship we have developed with TSA. What I really want to talk to you about now is our in-house R&D efforts on a product called COBRA (Carry-On Baggage Real Time Assessment). We believe that this product has the ability to revolutionize today's checkpoint.

COBRA represents the next generation in aviation security as the first automatic explosives detection system designed to easily integrate into the operational flow of a checkpoint. Designed, developed, and manufactured with our own funding, COBRA is a revolutionary advance over today's conventional line scan X-ray systems. It integrates Computed Tomography (CT) scanning and leading edge image interpretation software to automatically screen carry-on baggage/bins for explosive materials, guns and knives. In addition to automatic threat detection and analysis, COBRA provides high-resolution, 3-Dimensional (3-D) images that can be rotated on the screen for on screen resolution decisions.

COBRA has just completed deployment of a pilot program with TSA at Boston's Logan Airport. The unit was installed downstream of the conventional X-ray systems at the US Air Shuttle Terminal. The trial was part of a TSA project to assess operational performance and to determine if COBRA should replace the currently installed, but outdated X-ray machines.

Early indicators and results from the successful trial are demonstrating that COBRA will save the screeners significant time. One of the biggest contributors to checkpoint bottlenecks is the need for the TSA screeners to double and triple check the one-dimensional images of the conventional systems. Screeners lose efficiency by repeatedly sending bags back through the conveyor because the conventional X-ray source is fixed and many objects that are on the same X-ray path are not imaged clearly or at all. Additionally, the orientation of an object is critical in how the image appears on the screen. A gun viewed from the wrong direction no longer appears as a gun, but instead appears as a rectangular block or stick. There are no hidden objects in the COBRA system. By rotating the X-ray source completely around the bag, a full-volume image is produced of the entire contents of the bag. All contents of the bag are imaged regardless of their orientation.

Another positive aspect of the trial is the improved and automated detection using COBRA. At today's checkpoints, detection of threats is almost always dependent on screener training, skill, attention level and is very dependent on object orientation and bag clutter. Small amounts of explosive materials are at best difficult to detect, and particular configurations are very difficult or impossible to detect. COBRA provides new capabilities of automatic threat detection and analysis for explosive materials in addition to guns and knives. This detection is computer based and does not rely on screener attention level. Detection is based on physical properties of the imaged objects. By automatically identifying and detecting explosives, weapons and a variety of other materials, the use of COBRA will reduce the need for screeners to view every bag which is a lengthy and tiresome process. The screener will only need to view those bags where the system indicates there is a suspect object which will increase throughput and reduce the number of screeners manning the system.

Another major advantage we are hearing from the Logan screeners relates to the quality of the image on the screen. Today's conventional X-ray systems provide a 2-D colorized image. In addition to a similar 2-D image COBRA provides a real three-dimensional (3-D) color image that can be rotated 360 degrees with the touch of a fingertip.

Other checkpoint issues are being addressed by COBRA. One of the main complaints for the business traveler is the requirement to remove their laptop computers from their briefcases. When using COBRA, these laptops and other electronic devices do not need to be extracted, saving time and improving efficiency. Prohibited items such as scissors, matches, and lighters present additional problems for screeners. With COBRA, these items are seen clearly in a 3-D image, and screeners can easily ask that they be removed, reducing the time taken to resolve prohibited items with hand searches.

In addition to addressing security concerns, COBRA technology also represents a significant labor savings for TSA. The screener workforce, working at our checkpoints today, are doing an excellent job given the limitations of conventional x-ray systems and ETDs. However, more screener personnel are required than needed in light of these limitations. The technology developed in COBRA can, and will essentially reduce that number of screeners anywhere from 30-50%.

COBRA is designed to be installed in less than four hours, is designed for serviceability and comes with a built-in tutorial. Its imaging and display technology was developed with TSA's human factors personnel and is a dramatic improvement over today's image-interpretation techniques. Perhaps one of the more "dramatic" reason for considering COBRA at today's checkpoint (to shore up a chink in the armor) was summed up best by one of the candidates in their 3rd Presidential debate – he said, "If we are employing CT EDS equipment for our checked luggage, why are we not then using that same technology at the checkpoint to inspect our carry-on luggage."

Furthermore, covert testing scores of our checkpoint screeners (that has been in the press of late) reveals that screeners, using the currently deployed equipment, are not up to the task of reliably finding explosives. Clearly, with using advanced technology such as COBRA that automatically detects explosives, those scores will only go higher and the public will benefit from the proportionate rise in security.

Recent events in Moscow with the Chechen suicide bombers made us reevaluate where the threat is to our commercial airliners today. Since Pan Am 103, we have been focused on deploying the best technology to detect the smallest amounts of explosives in checked luggage. Unfortunately, the threat today is different. We have seen how passengers can now bring small amounts of explosives in their carry-on items or on their person. The threat is no longer limited to screening all the bags in the belly of the aircraft. An equal focus must be on the passenger and their carry-on items. Our COBRA system, developed and leveraged from all our work on our checked baggage EDS systems, will provide TSA with the latest technology as advanced or even superior to the technology now installed for checked luggage. The time that passengers wait in lines will be reduced and the operating costs will be a fraction of what they are today.

The next step is to provide this technology in a way that affords frictionless travel, an integrated checkpoint that is user friendly but at the same time is fully capable of detecting small amounts of explosives in a passenger's hand bag or on his/her person. Analogic is working with other companies in the security industry to provide an integrated secure checkpoint. TSA's main focus to date has been to roll out products and test them. Significant progress has been made and it is my belief that our airports are much safer today than prior to 9/11. However, I also know that the 1266 EDS machines that were installed across the country were done in a way that emphasized speed of installment rather than the ease of travel for the flying public. Analogic is doing our part to improve the situation. We are working with TSA to not only enhance the systems currently installed, but to reduce the lifetime costs of ownership. We, as a company, see the checkpoint as a natural focus to bring all our technology to bear to not only improve their security, but to do it a way that is also in the best interests of the passengers and the TSA.

We look forward to working with TSA and DHS in the future and to also address other venues such as rail stations, subways, ports and other critical infrastructure.

Thank you. I will be happy to answer any questions that you may have.

Attachment: Comparison between a conventional line scan x-ray system and Analogic's COBRA, an advanced Explosive and Weapon Detection System

Attachment to John Wood's Testimony on July 13, 2005 @ 2:00 PM

Comparison between a Conventional Line Scan X-ray system and Analogic's COBRA, an Advanced Explosive and Weapon Detection System

Overview: Literally thousands of conventional X-ray systems are installed at airport checkpoints, office lobbies, agency entrances and other locations around the world. They are used for one purpose – to detect dangerous objects inside bags. They can provide an excellent image (sometimes colored for organic materials) and are relatively inexpensive (\$30-\$60,000). They operate on the principle of a Transmission X-ray (TRX) imaging system that has a source (an X-ray generator), detectors which capture the X-rays that have penetrated through the bag, and a monitor that displays the resulting projection image. A conveyor belt takes the bag through the system.

Analogic's COBRA™ (Carry-on Baggage Real Time Assessment) represents a revolutionary advancement over these conventional systems in that it employs Computed Tomography (CT) scanning, the same technology currently deployed by the TSA to screen checked baggage. As objects (bags or bins) move through the COBRA, the system performs full-volume helical CT scans and analyzes the 3-dimensional images using advanced explosive and weapon detection algorithms. In addition to automatic threat detection and analysis, the high-resolution, 3-D images can be rotated on the screen to clearly identify hidden or obscured objects.

Conventional Systems**COBRA**

<p>Physics: A conventional X-ray system has a fundamental limitation in that the three-dimensional volume of a bag is compressed to a two-dimensional image. Because of this, all the objects in a bag are superimposed on top of each other, which results in reduced detection of threat objects. Numerical values in the image represent summations along the line of the X-ray penetration. Image interpretation is difficult for both computer-aided (automatic) and operator detection.</p>	<p>Physics: Recognition of the fundamental limitations of conventional X-rays led to the development of Computed Tomography (CT). COBRA uses volumetric CT, an advanced diagnostic imaging method in which X-ray measurements from many angles are combined into one image. In COBRA the combination of X-ray source rotation and bag motion produces true 3-dimensional images of all the contents of the bag. The numerical values at each point in space represent material specific properties of the contents of the bag.</p>
<p>Technology: 1970's</p>	<p>Technology: 21st Century</p>
<p>The hidden object - Because the X-ray generator is fixed (doesn't move), X-rays go through a bag at a fixed angle. Any threat object that is on the same X-ray path as another</p>	<p>No hidden object: There are no hidden objects in the COBRA system. By moving the X-ray source completely around the bag (on the rotating gantry),</p>

<p>item is not imaged clearly or at all. For example, if a threat object is behind (or in front of) a radio, the conventional TRX will show an image of the radio, but may not show the threat. This is why many operators using this technology will have the bag rescanned in a different orientation so that they can see behind the obscuring object. This re-scanning takes time and is inefficient. Additionally, the orientation of an object is critical in how the image appears on the screen. A gun viewed from the wrong direction no longer look like as a gun, but instead appears as a rectangular block or stick.</p>	<p>a full-volume rendering is produced of the entire contents of the bag. All contents of the bag are imaged regardless of their orientation.</p>
<p>Detection: Conventional systems may detect guns and knives as long as they are not obscured by other objects or in a difficult orientation. Detection is almost always dependent on screener training, skill, and attention level. Explosive materials are at best difficult to detect, and particular configurations are very difficult to detect.</p>	<p>Detection: COBRA provides automatic threat detection and analysis for explosive materials in addition to guns and knives. This detection is computer based and does not rely on screener attention level. Detection is based on physical properties of the imaged objects.</p>
<p>Certification: Conventional systems are not certified for automatic detection of explosives.</p>	<p>Certification: CT is the preferred, “certified” detection technology used by the TSA for automatic detection of explosives in checked luggage. Analogic is one of three (3) companies who have passed the TSA certification testing for checked baggage EDSs.</p>
<p>Image on Screen: A 2-D colorized image</p>	<p>Image on Screen: In addition to a 2-D image of the entire bag, COBRA provides a high-resolution, 3-D image that can be rotated with the touch of a fingertip.</p>
<p>Laptop Computers: Laptop computers must be extracted from bags using conventional X-ray systems</p>	<p>Laptop Computers: Laptop computers do not need to be extracted while using COBRA.</p>

Conventional systems cost less than their CT counterparts, but given the severity of the threat and the acceptance of this certified technology, TSA should move quickly to adopt it in today’s checkpoints.

